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Original Research

Storage Stability of Walnut Kernel Incorporated Healthier Meatballs (*Goshtaba*)

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Abstract

The functional value of meatballs (Goshtaba) was improved by enriching them with the optimum level of walnut kernel paste. The functional meatballs were packed in LDPE pouches to study their quality behaviour at refrigeration temperature for a period of 21 days. The pH, moisture and TBARS showed a significant increase with the advancement of storage. The standard plate count and Psycrophillic count significantly increased from day 0 to day 21. Coliform count showed growth after day 7 which increased significantly up to day 21. However, the values of microbial counts were within acceptable limits up to day 14 of the storage period. Although the sensory scores decreased with storage period for all attributes, but remained acceptable up to day 14. Thus, it was concluded that walnut kernels can be efficiently incorporated into meatballs (Goshtaba) to improve their functional value without affecting their storage stability for at least 14 days at refrigeration temperature.

Keywords: Functional, *Goshtaba*, Meatballs, Refrigerated Storage, TBARS, Water Activity.

Introduction

Humans have been consuming meat for ages as it contains valuable amounts of high- quality proteins, fatty acids, vitamins, minerals, micronutrients, fats and other bioactive compounds (Bagona *et al*., 2013). It is also a source of many health-promoting components such as conjugated linoleic acid (CLA), iron, zinc, selenium, L-carnitine, histidyl dipeptides, creatine, taurine, glutathione, etc. (McAfee *et al*., 2010). According to 20th Livestock Census, the total livestock population in India was 535.78 million, of which sheep contributed 74.26 million (13.87%) of the total livestock population. The total meat production in India was found to be 9.29 MT, of which sheep meat share is 10.33 percent (DAHD, 2023).

India being a conglomerate of several cultures and traditions is home to many ethnic meat products. Ethnic meat products are high sensory quality foods, with high nutritional value and are produced on a small scale by using ingredients and procedures from ancient times. They are generally popular locally in a particular geographical area. *Wazwan* is the famous cuisine of Kashmir Valley. The term *Wazwan* has been derived from two Kashmiri words i.e. "*waza"* meaning chef/cook and "*wan"* meaning shop.

Goshtaba is an inseparable emulsion-based comminuted meatball, a product of Wazwan. Traditionally, a considerable amount of fat (about 20-30%) is used in the formulation of *Goshtaba* to achieve a stable emulsion and also to impart a special taste and flavour to the product which has raised concerns among health-conscious consumers that necessitated the need to reduce and/or replace the total fat content in this product. The overall product functionality can be improved in various ways like fat profile modification such as increasing healthy fats (omega 3 fatty acids, etc.) and adding other health-improving components (Zhang *et al*., 2010).

Walnut kernels contain 4% water, 15% protein, 65% fat (mostly omega fats), 14% carbohydrates, and 7% dietary fiber (Sen and Karadeniz, 2015). Since walnuts are a rich source of many phytochemical substances that have antioxidant effects and can also prevent aging, cancers, inflammations, and neurologic illnesses (Sen and Karadeniz, 2015), the incorporation in *Goshtaba* could prove beneficial in enhancing its functional value. This study is one attempt wherein the storage stability of meatballs with low fat and antioxidant contents are being evaluated.

Materials and Methods

Lean meat obtained from hind leg portions of the freshly dressed sheep carcasses (12-18 months old male animal) was used along with animal fat and other ingredients for the preparation of meatballs. Table salt, vegetable oil, and walnut kernels used in product preparation were procured from the local market as per requirement. Walnut kernels were ground in a grinder to form a fine paste needed for product preparation.

Mutton chunks and mutton fat were minced separately through 8 mm plate in a meat mincer. The required quantity of minced meat was placed in the bowl chopper and chopping was done for 1 minute. To this, 2.5% table salt was added and chopping was continued for a further 1 minute after which minced mutton fat was added and chopping was continued for 2 minutes. At this stage, 10% chilled water was added and again chopping was done for 2 minutes. Large cardamom seeds and walnut kernel paste were added towards the end and chopping was continued for further 1-2 minutes to obtain an emulsion of desirable quality. The emulsion was moulded in the shape of spherical balls and were kept under refrigeration for half an hour and cooked in their respective gravies. The core temperature of meatballs was recorded by using a probe thermometer, which showed a core temperature of 72° C at the end of the cooking process. The cooked product was cooled to room temperature and analysed for different parameters.

Analytical Procedures

The pH of the cooked samples was determined as per the method of Trout *et al*. (1992) by using a digital pH meter (Model CP 901, Century Instruments Ltd., and India). The percentage moisture of the product samples were evaluated as per the standard procedure of AOAC (2019) using a hot air oven. The water activity was estimated as per standard procedure of AOAC, 2019 by using Pre Aqua Water activity analyzer. The instrument was first calibrated with 1.00 a_w primary standard reading and 0.760 a_w secondary standard reading. The different samples were placed in different sample cups and the final readings were displayed on the screen after the instrument beeped. The estimation of TBARS value was done by following the method of Witte *et al.* (1970) with slight modifications. 5g aliquot of the sample was taken and triturated with 25 ml of pre-cooled 20% trichloroacetic acid (TCA). The

contents were then quantitatively transferred into a beaker by rinsing with 25 ml of chilled distilled water, well mixed and filtered through ash less Whatman filter paper No. 1 (GE Healthcare, U.K). A quantity of 5 ml of TCA extract (filtrate) was mixed with 5 ml of TBA reagent (0.01M) in duplicate test tubes and placed in hot air oven for 30 minutes until colour develops. A blank sample was made by mixing 3 ml of 10% TCA and 3 ml of the TBA reagent. Absorbance (O. D.) was measured, at fixed wavelength of 532 nm using UV-VIS spectrophotometer (HITACHI, UV-Spectrophotometer U-1800, Japan). The TBA value was calculated as mg malonaldehyde per kg of sample by multiplying O.D. value with k factor 5.2.

Microbiological Analysis

The samples of meat products were subjected to microbiological analysis for standard plate count, coliform count and psycrophillic count as per the method described by APHA (1984). The cfu/g was calculated by taking average number of colonies which was multiplied by reciprocal of the dilution factor and expressed as $\log_{10}$cfu/g of sample.

Sensory Evaluation

The sensory evaluation of the products and their gravies were conducted wherein the product chunks in their respective gravies were served hot to the panellists comprising of scientists and post graduate students of the Division of Livestock Products Technology, Shuhama. The product samples and their gravies were evaluated for various sensory parameters viz. appearance, flavour, texture, juiciness, consistency, binding, saltiness, mouth coating and overall acceptability using 8-point descriptive scale, where 8=extremely desirable and 1=extremely undesirable. Water was provided to the panellists to rinse the mouth at intervals between different samples.

Statistical Analysis

The data generated was analysed statistically using the software of Statistical Package for Social Sciences (SPSS-Base 20.0). Analysis of variance by one way and independent T- Test was computed and significance of mean was tested at 5% level of significance.

Results and Discussion

Quality Evaluation of Goshtaba Incorporated with Walnut Kernels During Refrigerated Storage (0-4^{o}c).

Physico-Chemical Parameters

An overall increase in pH was observed in control and walnut kernel incorporated *Goshtaba*. Increase in pH of products during storage could be due to production of basic amines from protein breakdown by increasing growth of micro-organisms with time. Rovida (2016) also reported significant increase in pH of mutton nuggets extended with walnut kernel paste. Moisture content increased in control as well as in walnut treated products. The increase in moisture content might be due to the increased pH throughout the storage period. Sahoo and Anjaneyulu (2000) in their study on the quality of pre-blended ground buffalo meat found a highly significant ($P<0.05$) correlation between meat pH and water holding capacity. An increase in water activity was observed in control and walnut treated products which might be due to the increased pH throughout the storage period. Similar findings were noticed by Hegazy *et al.* (2011) in beef burgers. TBARS values of all the treatments were lower than control. There was an increase in the TBARS values in control as well as treatment products throughout the storage period which might be due to the lipid oxidation and the production of volatile metabolites in the presence of oxygen owing to oxygen permeability of packaging material (Rovida, 2016). The increase was however lesser in walnut treated samples, probably due to antioxidant properties of walnuts. Similar findings are reported by Bhat *et al.* (2014) in *Aloe Vera* enriched chicken nuggets; Banerjee *et al*. (2012) in goat meat nuggets containing broccoli powder extract. Serrano *et al*. (2006) reported that TBARS value increased in restructured beef steak incorporated with different proportions of walnut over the first 72 days then decreased as from day 92. The mean TBARS values during the whole storage period were below the permissible value of 1-2 mg malonaldehyde/kg meat.

Microbiological Evaluation

Standard plate count of control was higher than walnut treated products. A comparatively slow increase in SPC of walnut kernel incorporated *Goshtaba* might be attributed to the possible antimicrobial activity of walnut kernels. Similar observation was reported by Rovida (2016) in mutton nuggets extended with walnut kernel paste. Coliform counts were not detected during initial period of storage upto 7th day in control as well as walnut treated samples. Similar results are reported by Rovida (2016) in mutton nuggets extended with walnut kernel paste. Mean coliform count of control and walnut treated samples increased significantly from 14th to 21st day of storage. An overall increase in Psycrophillic count was observed in control and walnut treated samples. Similar results are reported by Yadav *et al.* (2018) in chicken sausages incorporated with wheat bran and dried carrot pomace. A comparatively slow increase in Psycrophillic count of walnut treated samples might be attributed to the possible antimicrobial activity of walnut kernels.

Table 1: Effect of storage period on physico-chemical quality, moisture, water activity and TBARS during refrigerated storage (4±1°C) of *Goshtaba*

Parameters	Treatment	Storage Days			
		0	7	14	21
pH	Control	5.12±0.005^{a1}	5.33±0.003^{b1}	5.52±0.002^{c1}	5.83±0.003^{d1}
	Treatment	5.21±0.003^{a2}	5.41±0.003^{b2}	5.61±0.003^{c2}	5.91±0.003^{d2}
Moisture (%)	Control	64.15±0.194^{a1}	66.13±0.235^{b}	68.42±0.236^{c1}	70.09±0.194^{d1}
	Treatment	62.63±0.151^{a2}	65.51±0.209^{b}	67.42±0.196^{c2}	69.03±0.161^{d2}
Water Activity (a_w)	Control	0.98±0.000^{a}	0.99±0.002^{b}	1.00±0.000^{c}	1.00±0.000^{c}
	Treatment	0.98±0.000^{a}	0.99±0.000^{b}	1.00±0.000^{c}	1.00±0.000^{c}
Tbars (mg malonaldehyde/kg)	Control	0.75±0.002^{a1}	0.97±0.002^{b1}	1.63±0.003^{c1}	2.17±0.002^{d1}
	Treatment	0.55±0.003^{a2}	0.71±0.002^{b2}	1.42±0.002^{c2}	1.98±0.002^{d2}

Mean ±SE with different letters (row wise) and different numerals (column wise) differ significantly; N = 6

Table 2: Effect of storage period on Standard plate count, Psycrophillic count and Coliform count of *Goshtaba* during refrigerated storage.

Parameters	Treatment	Storage Days			
		0	7	14	21
Standard plate count (SPC) (log 10 cfu/g)	Control	2.11±0.004^{a1}	2.61±0.003^{b1}	3.43±0.003^{c1}	4.45±0.002^{d1}
	Treatment	2.07±0.003^{a2}	2.54±0.002^{b2}	3.37±0.002^{c2}	4.41±0.003^{d2}
Psycrophillic count (log 10 cfu/g)	Control	1.20±0.004^{a1}	1.77±0.003^{b1}	2.22±0.002^{c1}	3.02±0.002^{d1}
	Treatment	1.11±0.002^{a2}	1.71±0.004^{b2}	2.15±0.003^{c2}	2.98±0.003^{d2}
Coliform count (log 10 cfu/g)	Control	ND	ND	1.08±0.002^{b1}	1.26±0.002^{c1}
	Treatment	ND	ND	1.03±0.003^{b2}	1.22±0.004^{c2}

Mean ±SE with different letters (row-wise) and different numerals (column-wise) differ significantly; N = 6

Table 3: Effect of Storage period on sensory attributes of *Goshtaba* during refrigerated storage (4±1°C)

Parameters	Treatment	Storage Days			
		0	7	14	21
General appearance	Control	7.87±0.091^{c}	7.80±0.107^{c}	7.13±0.133^{b}	6.60±0.190^{a}
	Treatment	7.67±0.159^{c}	7.60±0.131^{c}	7.13±0.091^{b}	6.20±0.107^{a}
Flavour	Control	7.60±0.131^{c}	7.80±0.107^{c}	6.33±0.126^{b}	4.47±0.133^{a}
	Treatment	7.87±0.091^{c}	7.73±0.118^{c}	6.47±0.133^{b}	4.60±0.131^{a}
Juiciness	Control	7.80±0.107^{c}	7.53±0.133^{c}	6.40±0.131^{b}	5.80±0.107^{a1}
	Treatment	7.73±0.118^{c}	7.47±0.133^{c}	6.33±0.126^{b}	5.40±0.131^{a2}
Texture	Control	7.80±0.107^{c1}	7.60±0.131^{c1}	6.33±0.126^{b}	5.27±0.118^{a}
	Treatment	6.73±0.206^{b2}	6.67±0.211^{b2}	6.27±0.118^{b}	5.20±0.107^{a}
Mouth coating	Control	7.40±0.131^{c}	7.27±0.118^{c1}	6.80±0.107^{b}	5.27±0.118^{a}
	Treatment	7.41±0.133^{c}	6.80±0.107^{b2}	6.60±0.131^{b}	5.20±0.107^{a}
OA	Control	7.80±0.107^{d}	7.33±0.159^{c}	6.33±0.126^{b}	5.47±0.133^{a}
	Treatment	7.81±0.126^{c}	7.53±0.133^{c}	6.60±0.131^{b}	5.60±0.131^{a}

Mean ±SE with different letters (row wise) and different numerals (column wise) differ significantly; N = 15

Sensory Attributes of *Goshtaba* During Refrigerated Storage

The sensory attributes were affected during 21 days of refrigerated storage. All the parameters showed a declining trend with storage. Mean scores for walnut-treated samples were comparable to the control. The decrease in appearance scores could be due to lipid oxidation resulting in the formation of excess metmyoglobin and non-enzymatic browning. Kandeepan *et al*. (2010) showed a decrease in appearance scores with increase in storage period. Decline in flavour scores was reported by Thomas *et al*. (2006) and might be due to the loss of volatile flavour components on storage of meat products. Decline in texture scores could be due to a decrease in the hardness of the products. Rovida (2016) also observed a decline in texture scores with increasing storage period. Juiciness decreased with increase in the storage period. Thomas *et al*. (2006) also found decrease in juiciness throughout the storage period. The overall acceptability scores decreased as the storage period progressed which might be because of the decline in scores of flavour and texture. Similar findings are reported by Rovida (2016) in mutton nuggets extended with walnut kernel paste.

Conclusion

The observations indicate that the functional meatballs (*Goshtaba*) incorporated with walnut kernels could be safely stored for 14 days at refrigeration temperature. The product was acceptable upto 14 days when judged from sensory as well as microbiological perspective. The value addition of meat is made possible by incorporation with health promoting natural plant-based ingredients and at the same time making the products available for consumers by employing suitable packaging and storage conditions.

Contribution by Authors

Each co-author contributes equally.

Conflict of Interests

There is no conflict of interest.

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References

1. AOAC (2019). Official Methods of Analysis 21st edition. *Association of Official Analytical Chemists*, Washington, DC.
2. APHA (2018). Compendium of Methods for the Microbiological Examinations of Foods.2nd edition. *American Public Health Association*, Washington, D.C.
3. Bagona, O., Alonsa, Franciso, J., Colmenero, Franciso, J. and Sanchez (2013). Development and assessment of healthy properties of meat and meat products designed as functional food. *Meat Science,* 95: 919-930.
4. Banerjee, R., Arun, K.V., Arun, K. Das., Rajkumar, V., Shewalkar, A.A. and Narkhede, H.P. (2012). Antioxidant effect of broccoli powder extract in goat meat nuggets. *Meat Science,* 91: 179-184.
5. Bhat, Z.F., Kumar, S. and Kumar, P. (2014). Effect of Aloe Vera on the lipid stability and storage quality of chicken nuggets. *Nutrition and Food Science,* 45: 54-67.
6. DAHD (2019). 20th Livestock Census. Livestock Production Statistics of India. *Ministry of Fisheries, Animal Husbandry and Dairying*, GOI.
7. Hegazy, A.I. (2011). Influence of using Fenugreek Seed Flour as Antioxidant and Antimicrobial Agent in the Manufacturing of Beef Burger with Emphasis on Frozen Storage Stability. *World Journal of Agricultural Sciences,* 7(4): 391-399.
8. Kandeepan, G., Anjaneyulu, A.S.R., Kondaiah, N. and Mendiratta, S.K. (2010). Quality of buffalo meat keema at different storage temperature. *African Journal of Food Science,* 4: 410-417.
9. McAfee, A.J., Emeir, M., McSorley, Geraldine, J., Cuskelly, Bruce, W., Moss, Julie M. W., Wallace, Maxine, P., Bonham and Anna, M. (2010). Red meat consumption: an overview of the risks and benefits. *Meat Science,* 84(1): 1-13.

10. Rovida, M. (2016). A study on the development of functional mutton nuggets incorporated with walnut kernels and saffron petals. MVSc Thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shuhama.
11. Sahoo, J. and Anjaneyulu, A. S. R. (2000). Effect of sodium ascorbate, alpha-tocopherol acetate and sodium tripolyphosphate on the quality of preblended ground buffalo meat. *Journal of Food Science and Technology*, 37: 388-393.
12. Sen, M. and Karadeniz, T. (2015). The Nutritional value of Walnut. *Journal of Hygienic Engineering and Design, UDC*, 634.1.
13. Serrano, A., Cofrades, S. and Jimenez- Colmenero, F. (2006). Characteristics of restructured beef steak with different proportions of walnut during frozen storage. *Meat Science*, 72: 108-115.
14. Thomas, R., Anjaneyulu, A.S.R. and Kondaiah, N. (2006). Quality and shelf life evaluation of emulsion and restructured buffalo meat nuggets at cold storage (4±1ºC). *Meat Science*, 72: 373-379.
15. Trout, E.S., Hunt, M.C., Johnson, D.E., Claus, J.R., Kastner, C.L. and Kropt, D.H. (1992). Characteristics of low fat ground beef containing texture modifying ingredients. *Journal of Food Science*, 57: 19-24.
16. Witte, V. C., Krause, G. F. and Bailey, M. E. (1970). A new extraction method for determining 2-thiobarbituric acid values of pork and beef during storage. *Journal of Food Science*, 35: 582-585.
17. Yadav, S., Pathera, A.K., Islam, R.U., Malik, A.K. and Sharma, D.P. (2018). Effect of wheat Bran and dried carrot pomace addition on quality characteristics of chicken sausage. *Asian-Australasian Journal of Animal Sciences*, 5: 729-737.
18. Zhang, W., Xiao, S., Samaraweera, H., Lee, E.J., Ahn, D.U. (2010). Improving Functional value of Meat Products. *Meat Science*, 86: 15-31.

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